mailed to the Patent Office once the pending claims have been allowed.

In order to expedite the prosecution of the present application, Applicants have amended Claims 11 and 12 to recite that a greater amount of biosludge is ozonized and converted into BOD components than excess sludge generated in the bioreactor. Support for this amendment can be found on page 28 of the present specification. Since this amendment places the instant application in better form for consideration on appeal, entry thereof is deemed proper under 37 CFR 1.116(a). Favorable consideration is respectfully solicited.

Claims 2, 5, 11 and 12 have been rejected under 35 USC 103 as being unpatentable over Dorau et al in view of Hei et al or Berndt or Kramer et al. Claim 3 has been rejected under 35 USC 103 as being unpatentable over Dorau et al in view of Hei et al or Berndt or Kramer et al and further in view of Brock. Claim 4 has been rejected under 35 USC 103 as being unpatentable over Dorau et al in view of Hei et al or Berndt or Kramer and further in view of Brock. Applicants respectfully traverse these grounds of rejection and urge reconsideration in light of the following comments.

As discussed previously the instant invention is directed to a process for treating an aqueous organic waste in which the aqueous organic waste is introduced into an aeration tank, the aqueous organic waste in the aeration tank aerated in the presence of a biosludge composed essentially of aerobic microorganisms to form an aerated aqueous suspension, the aerated aqueous suspension withdrawn from the aeration tank and introduced into a solid/liquid separation unit, the aerated aqueous suspension is subjected to solid/liquid separation in the solid/liquid separation unit to form a separated sludge containing the biosludge and a separated liquid phase withdrawn from the process as treated water, at least a portion of the separated sludge being recycled back to the aeration tank, either aerated aqueous suspension withdrawn from the aeration tank or a part of the separated sludge being ozonized, with a greater

amount of biosludge being ozonized and converted into BOD components than excess sludge generated in the bioreactor, the ozonizating taking place at a pH of 5 or lower, and either the ozonized aerated aqueous suspension or the ozonized part of the separated sludge recycled back to the aeration tank for aerobic biological treatment.

The present invention enables an aerobic biological treatment process to be carried out in a manner so that the accumulation of excess sludge in the reaction system can be avoided and thereby eliminate costly methods of disposing of the excess sludge.

With the present invention, it is possible to realize a decrease in the amount of excess sludge generated by extracting a part of the biosludge from the entire treatment system and subjecting it to an ozone treatment to convert it into biodegradable BOD components and returning these biodegradable BOD components to the biotreatment reactor. As such, the biosludge that is ozonized may be either the separated biosludge or slurry present in the aeration tank. The amount of biosludge that is subjected to an ozone treatment is greater than that exhausted from the system as excess sludge. By returning the ozonized biosludge to the aeration tank, an amount of excess sludge is withdrawn from the system which corresponds to the amount of biosludge proliferated in this system to maintain the total amount of biosludge in the entire system constant. When the amount of biosludge subjected to an ozone treatment corresponds to that of excess sludge, a "zero excess sludge operation" cannot be realized since the amount of biosludge corresponding to the amount of proliferation due to biogestation of the ozonized biosludge will remain as an increment to be exhausted as an additional excess sludge. In the present invention, it is possible to let the amount of excess sludge be close to zero by subjecting a greater amount of biosludge than that formed during the biotreatment to ozonization to convert it into easily biodegradable BOD components. It is respectfully submitted that

the art cited by the Examiner does not disclose the presently claimed invention.

The Dorau et al reference is directed to a method and apparatus for biologically treating sewage containing difficultly biodegradable substances. This method requires the steps of subjecting sewage to a biological treatment in a bioreactor 3 with the resulting biosludge being separated from the treated liquor by a membrane filter 9 and the filtrate 11 being concentrated in a basin 15 and introduced into a reactor 31 to subject it to a chemical treatment, such as an ozone treatment to convert the difficultly biodegradable substances into easily biodegradable substances which are then recycled back to the bioreactor 3 for biodegradation. In the process of Dorau et al, the biosludge separated in the membrane filter is either returned back to the bioreactor without being further treated or exhausted out of the system as excess sludge 13. This reference has no disclosure of subjecting BOD components in the excess sludge or in the aqueous aerated suspension to an ozone treatment. As such, by the process disclosed in this reference, a reduction in the amount of formed excess sludge cannot be attained, even by ozone treatment of difficulty biodegradable substances.

In the present invention, the biosludge is subjected to an ozone treatment to convert it into BOD components to be subject to biodegradation in order to reduce the amount of excess sludge to be formed during the biotreatment. Here, the living cells of microorganisms constituting the biosludge are destroyed by the ozone treatment and converted into easily biodegradable substances, which is different from the teaching of Dorau et al in which difficultly biodegradable substances but not the living cells of microorganisms are subjected to ozone treatment.

Biosludge is biologically stable because it is composed of living microorganisms and undergoes a biological digestion attaining a reduction of the amount of biosludge of no more than 50% with the remainder being held unchanged and difficult to treat. The reason for this is based on the characteristic property of the living microorganisms constituting the biosludge.

The microorganisms included in the biosludge are facultative anaerobic bacteria which live on ordinary aerobic respiration utilizing atmospheric oxygen under an aerobic condition and live on a respiration utilizing the oxygen in a phosphorus compound within the body of the microorganism under anaerobic condition. Therefore, the microorganisms in the biosludge cannot be destroyed by merely changing the external condition from aerobic to anaerobic state. The no more than 50% reduction of the biosludge amount by the anaerobic or aerobic digestion is due to the metabolization of organic substances existing in and out of the bacterial cells by the microorganisms and the living cells will remain undestroyed after such a biological digestion and no decrease in the substantial amount of the living cells can be attained.

As such, the present invention provides a technique for decreasing the amount of excess sludge in a biotreatment of an aqueous organic waste by ozone-treating the biosludge formed upon the biotreatment to convert the biologically stable biosludge into easily biodegradable substances.

Dorau et al fails to teach an ozone treatment of the concentrated sludge separated in the membrane filter 9 and, therefore, no decomposition of the biosludge is contemplated by Dorau et al and the living cells will continue to proliferate. When the total amount of the biosludge composed of proliferating microorganisms is recycled back to the bioreactor, the reactor will suffer from clogging and eventually fill up with the growing amount of biosludge so that satisfactory biotreatment will no longer be possible with the result that a part of the biosludge has to be discharged out of the reactor as an excess sludge. By ozone treatment of difficultly decomposable substances not containing living biosludge, no decrease in the amount of excess sludge can be attained.

Hei et al discloses the use of a potentiated aqueous ozone cleaning composition for the removal of contaminated soil from a surface. This reference has a discussion with respect to the solubility and instability of ozone at various pHs. Apparently,

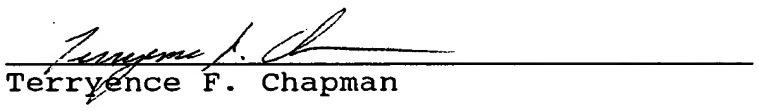
Berndt and Kramer were also cited for their similar disclosures. The fact that ozone may become more unstable at higher pHs has no correlation at all with respect to the reaction efficiency of ozone at the presently claimed pH range. There is no teaching contained in any of these references which would lead one of ordinary skill in the art to conduct ozonation of a biosludge at a pH of 5 or lower. As such, these references add nothing to the previously discussed references.

The Brock reference has a general discussion of microbes. There is no teaching contained in this reference which suggests the use of microbes with the ozonization treatment of biosludge. Moreover, since the primary reference differs fundamentally from the present invention in that it teaches the ozone treatment of filtrate through a membrane and not the ozonization of a biosludge as required in the present invention, the references cited by the Examiner would not suggest to one of ordinary skill in the art to treat a biosludge at a pH of 5 or lower.

As pointed out previously, comparative example 2 on pages 55 and 56 perform ozone treatment at a pH of 7. The results of this example show that the rate of formation of the excess sludge was the same as if the ozone treatment was omitted. Likewise with respect to comparative example 6 in which the pH was 7 during the ozone treatment. Although the references cited by the Examiner do not present a showing of prima facie obviousness under 35 USC 103, the objective evidence of unobviousness contained in the present specification clearly establishes the patentability of Applicants' requirement that the ozone treatment of the biosludge be conducted at a pH of 5 or lower.

The Examiner is respectfully requested to reconsider the present application and to pass it to issue.

Respectfully submitted,



TFC/smd

Terryence F. Chapman

FLYNN, THIEL, BOUTELL & TANIS, P.C.
2026 Rambling Road
Kalamazoo, MI 49008-1699
Phone: (616) 381-1156
Fax : (616) 381-5465

Dale H. Thiel	Reg.No. 24 323
David G. Boutell	Reg.No. 25 072
Ronald J. Tanis	Reg.No. 22 724
Terryence F. Chapman	Reg.No. 32 549
Mark L. Maki	Reg.No. 36 589
David S. Goldenberg	Reg.No. 31 257
Sidney B. Williams, Jr.	Reg.No. 24 949
Timothy B. Clise	Reg.No. 40 957

Encl: Postal Card

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